project WEB

Winter 2000

Connecting Projects WILD, WET and Learning Tree in New Hampshire

LEARNING IN A WINTER WONDERLAND

Wintertime in New Hampshire often conjures up picturesque Normal Rockwell images of snow quietly falling on landscapes blanketed in white. And popular literature and songs can often depict winter as a time when the world and Mother Nature are asleep. However, the truth is that if you know where to look, the outdoors is very much alive and active during the winter.

Your students are probably full of questions about the changes that occur in winter. Why do some birds fly south for the winter while others remain? What causes fewer daylight hours? Why do trees lose their leaves? How do fish live in lakes that are covered with ice? Do bears really hibernate? All of these questions could form the basis of lessons that could keep you and your students going well into spring.

We encourage you to explore the mysteries of the New England winter and hope this issue of Project WEB will get you thinking about winter environmental topics that may intrigue your students. Good luck and happy discovering!

IN THIS ISSUE

ICE STORM '98 REVISITED

By: Karen Bennett,
UNH Cooperative Extension

Severe, unpredictable weather is as much a part of New England as stunning fall foliage, baked beans, seafood and maple syrup. On January 5-16, 1998, a series of freezing rain storms blanketed three Canadian provinces and much of New Hampshire, Vermont, Maine, and New York. Ice developed when warm moist air from the Gulf of Mexico flowed over cold, dense arctic air. As the moisture fell, it cooled and froze. Homeowners in the severely hit areas talk of hearing hours of thunderous rifle-like shots as tree limbs broke. An estimated 800,000 acres were damaged in New Hampshire.

Trees experienced three kinds of damage: leaning and bending, broken branches, and broken tops. The severity of the damage was related to the aspect and slope of the land. Trees on south and southeast slopes and at elevations of at least 1300 feet in the southern part of the state and 1600 in the North Country were hardest hit. Though some softwoods were effected, this storm damaged mostly hardwoods.

Ice Storm *continued on page 4*

ERIC ALDRICH PHOTO © 2000

The morning after ice storm 1998

FIRST SNOW

Snow makes whiteness
where it falls.
The bushes look like
popcorn balls.
And places where I
always play,
Look like somewhere
else today.

- Marie Louise Allen

UNDER THE ICE

N.H. Lakes in Winter

ADAPTED FROM ARTICLES FROM VERMONT DEPT. OF ENVIRONMENTAL CONSERVATION'S *Out of the Blue* AND BY JODY CONNOR, DES

When people haul up their docks and boats and close up their lake cottages every fall in preparation for the winter months, the full time in-lake "residents" also prepare for the long, cold months ahead.

In the fall, solar energy to the lake from the sun is reduced and the upper layer of the water column cools. Each lake cools at a different rate, with smaller, shallower lakes cooling more quickly than large, deep lakes. As water cools, its molecules move more slowly and come closer together, increasing its density. This cooler, denser water tends to sink toward the lake bottom. This sinking combined with wind action causes the mixing of the upper and bottom layers of the water column. Known as fall turnover, this mixing typically occurs during the months of October and November, and causes a uniform temperature and an even distribution of nutrients throughout the water column.

By the end of November, many New Hampshire lakes reach their maximum density of 1.000 at 39°F (4°C). The coldest water temperatures (1° to 3°C) cover the top of the lake and protect the lake from heat stored below. A lake usually freezes over with its first permanent ice layer on a cold, calm night. When ice forms, the water molecules slow down and spread out in a lattice-like pattern. This increases the distance between the individual molecules, resulting in the ice being less dense (0.9168) than the cold water around it. This phenomenon causes ice to float on the surface. In this position, it acts as an insulator and prevents the water below from freezing, which allows aquatic organisms to survive through the winter.

During this time, aquatic species go through chemical, physical, and biological changes for the onset of winter. The metabolic rates of aquatic animals decrease and plant photosynthesis is slowed by the changes in day length and cooler temperatures.

Algae, which are the primary producers in the food chain, go through many changes as the winter approaches. Winter algae populations are affected by the amount of nutrients available, the cold water temperature and the decreased sunlight penetration. The community of winter algae beneath the ice is usually dominated by small and often motile (capable of spontaneous movement) algae found in a narrow layer of light penetration beneath the ice cover. These cold-water, low-light adapted algae are quite species specific in their tolerance to light quantity and quality. Diatoms that have adapted to low light levels and cool water temperatures are the most dominant winter algae in New Hampshire.

In most cases, the blue-green algaes (those typically seen during the summer season) do not do well under winter conditions. Some species will produce akinetes, or specialized resting cells. These specialized cells form when conditions in the water column are not conducive to algae growth. The akinetes overwinter in the lake's sediments and begin to proliferate when more favorable conditions appear.

The zooplankton community, minute floating or weakly swimming animal life, is very important to the lake system. Zooplankton are important food source for many fish. Some zooplankton are perennial and overwinter in low population densities as female adults while others may produce resting eggs when conditions are not favorable.

The algae and zooplankton populations that remain in the water column are the primary source of food for fish in the winter. Early winter is a stressful time for the fish as they begin the process of winter acclimation. The fish respond by decreasing the level of lipids (fats) and increasing the level of blood glucose in their bodies to build up their tolerance to the cold. Although fish remain active throughout the winter months, their movements are more restricted at this time.

Each plant species has a different means of overwintering the harsh northern New England climate.

Many plant species remain active during the winter months and continue to photosynthesize under the ice. These hardy winter plants help oxygenate the water and provide habitat for fish and aquatic wildlife. Each plant species has a different means of overwintering the harsh northern New England climate. Some plants produce an abundance of protected seeds before

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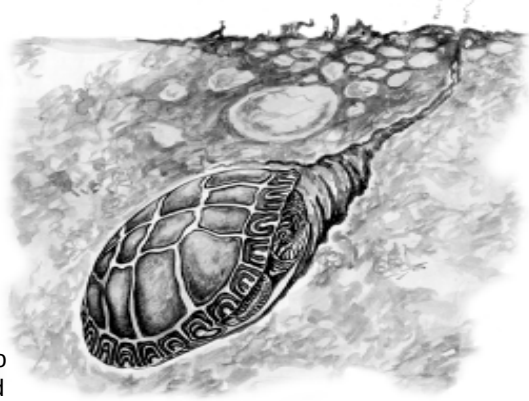
the plants are killed by the frost. These seeds remain in the sediment until spring when they begin the life cycle over. Other aquatic plants, such as the pondweed, bladderwort and milfoil, have special vegetative structures called turions. These winter buds develop during the late summer and early fall. In some species, the buds detach from the plant, while in other species they may remain attached to the plant. The buds sprout green shoots when the growing conditions improve. Water lilies overwinter with a rhizome root structure. The rhizome and tubers are large underground root structures that store carbohydrates and nutrients.

Luckily for the plants and animals that exist in New Hampshire lakes, water has a high specific heat. This is a physical attribute that causes lakes and ponds to go through gradual temperature changes, providing plants and animals time to adapt to seasonal changes. If it were not for these unique properties of water (its high specific heat and the density differences that exist between ice and cold water) imagine what would happen to lake life if a late August night was below freezing – you might awaken to a lake that had frozen solid in one night!

Reptiles and Amphibians In Winter

Turtles must keep from freezing, yet stay cold enough to slow their metabolism for as long as six months. While in this state, they use little energy and lose little weight.

Painted turtles don't even breathe during hibernation, but manage to get some oxygen from the water by absorbing it through their skin and throat linings. They give off carbon dioxide in the same manner. For these turtles, the greatest stress of hibernation comes when lactic acid builds up in their bodies. So they've adopted many ways to survive, such as drawing calcium carbonate from their shells to neutralize the lactic acid.



A painted turtle hibernating in pond mud.

Turtles aren't the only animals that hibernate in pond mud. Green and bull frogs also burrow into the mud. They do this by dramatically decreasing their heartbeat, breathing rate and body temperature. Those amphibians and reptiles not found in ponds cope with winter in varying ways. Spring peepers and gray treefrogs spend the winter on the surface of the soil covered by leaf litter, logs, tree roots, or other material. Air temperatures can commonly get as low as 10 to 15 degrees. Their bodies actually freeze with ice crystals forming inside of them. Research has shown peepers and treefrogs use glucose as an antifreeze that limits dehydration and protects their cells from damage. What spotted salamanders do in winter is still unknown.

Different kinds of snakes use different strategies for coping with winter. Common garter snakes migrate to a den. These den sites may have only a few snakes or thousands. They appear to be able to withstand some freezing temperatures without stress or damage. Northern water snakes overwinter in mud in the bottoms of ponds or streams. Hognose snakes begin to move to overwinter sites in early September. Their overwinter sites may simply be beneath debris or in deep crevices, but they do not appear to concentrate at den sites.

Activities Related to Articles in This Issue

Project WILD suggests

In *Stormy Weather*, students participate in a guided imagery activity to simulate the experiences of an animal in a storm.

Art teachers can use the *Tracks* activity to have students make plaster casts to help identify common animal tracks.

Project Learning Tree suggests:

In *Tree Cookies*, students learn about a tree by looking at its annual rings. Tree rings show patterns of change in a tree's growth from season to season, as well as changes in the area where it grows.

Trees in Trouble examines symptoms and causes of distress and disease in trees. It also compares environmental conditions that affect both human and plant health.

The activity *Tree Lifecycle* compares a tree's life cycle to a human's life cycle and explains the role of each stage of a tree's life in the forest ecosystem.

Project WET suggests:

Adventures in Density uses science and literature to help students understand the changes in density that result in the different states of water.

The activity *Molecules in Motion* has students role play the effects of heat energy on the different states of water to understand the formation of ice and other water situations.

In *Hangin' Together,* students experience types of bonding in frozen and liquid water.

ICE STORM *continued from page 1*

A Look Back and a Look Forward

Weather events become mythic and pass into legend because they are memorable, a little more extreme and unusual than the norm. Ice storm '98 is joining the hurricane of '38 and the blizzards of '69 and '77 as just such events. Does ice storm '98 signal a change in the earth's climate? It's natural to speculate after experiencing such an event. Though the January ice storm is the worst on record for this region, other storms are well documented. Eight major ice storms have hit this area. The most similar in geography and severity occurred in 1929. At that time, *The Concord Monitor* reported the storm was "...One of the most severe storms to hit New England for several years...did untold damage for several days." This description could have easily been written in 1998.

Though emerging consensus among the scientific community is that the global climate is changing, we don't know if the ice storm of 1998 means anything more than the right (wrong) jet streams mixed at the right time. Regardless, the storm had an immediate and long lasting affect on New Hampshire's forests and trees.

ERIC ALDRICH PHOTO © 2000

Three inches of ice cover some shrubs on top of Pitcher Mountain.

Assessing Trees and Forests

Trees can survive the loss of much of their tops. The likelihood that an individual tree will survive can be predicted by the amount of top that remains. Trees that lose more than 75% probably won't survive. However, not all trees with this amount of damage should be harvested. Leaving them will result in loss of timber value for the land owner, but the contribution they make to overall forest health may far outweigh the economic loss, especially when they're scattered and in areas difficult to harvest. Standing dead and dying trees are used by a variety of wildlife for nesting, roosting, and foraging. Hardwood and softwood trees over 18 inches in diameter have particular value. As trees of all sizes die and fall, they contribute to coarse woody debris on the forest floor that is important for nutrient recycling and wildlife habitat.

Most trees that lose between 50 and 75% of their top will survive with different degrees of internal infections and suppressed growth, depending on where the breakage occurs. Outer branch breakage results in limited infection. Breakage of large tops and lower branches results in more extensive infection.

Most of the trees that lost less than 50% have a good chance of fully recovering. Growth in some trees slows because of crown loss, though growth in lightly or undamaged trees on the edges of disturbed areas may increase due to additional sunlight. Unless there is substantial damage to the main stems, it is probably not necessary to remove these trees. As long as the main stem is intact, loss of wood should be minimal.

Lingering Concerns

Widespread scattered debris and impeded woodland access heightens hazards for anyone who works and recreates in the woods, and increases the likelihood of wildfire. Using history to predict future forest fires is complicated because this storm left debris in a different pattern than past hurricanes and windstorms. The '38 hurricane, for example, left heavy amounts of large, softwood fuel that took years to decay and set the stage for some of our most disastrous fires. However, this storm left primarily small-to-medium size hardwood fuel that should decay more quickly. This difference in fuel size and type may be in our favor. However, many more people live in and recreate in the forest than 50 years ago, increasing the chances of a forest fire and the damage that may result to life and property.

Opportunities for Research

The silver lining to the "ice" cloud is the unique opportunity for research. Dr Kim Babbitt, UNH Department of Natural Resources, is examining how changes in the forest canopy affect the microhabitat

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BLANKET PROTECTION

For many plant and animal species snow means survival. That is because it acts as insulation. Air trapped in spaces between the snow particles keeps earth-warmed air in and cold air out.

To the animals that must survive winter, the need for snow and differences in snow cover types are an essential part of life. The area between the ground and the snow is called the subnivean layer. Gradually, the snow changes into a lattice-work of ice and air spaces, where the temperatures can range from 20 to 30 degrees F. Here the environment is nearly dark even during the day. For small mammals-shrews, moles, voles and mice-a foot of snow cover means survival because of its insulating capacity. This is because their body surfaces are so great in proportion to their volume that they cannot eat enough to replace the lost heat quickly enough. Because of their small size, they are less able to carry a thick coat to withstand continual exposure to the weather. In addition, weeds and grasses flattened by the snow add seed heads to the available food that has been stored for winter use. The bark of shrubs and small trees and surface roots, provide another food source.

Snow depth also affects other animals. Six inches of snow presents no problem for red fox to travel over, but when the snow gets deeper, the animal uses more energy to catch its prey because it must bound through the snow. Red squirrels depend on tunnels in the snow for food storage and escape routes. As the snow gets deeper, it helps snowshoe hare increase their reach level as they search for buds and twigs.

Variations in the types of snow can mean life or death to those that live in or walk on it. Predators, such as fox, coyote and even bobcat, will have trouble hunting in deep dense snow. Powder snow has great insulation properties and is light enough for heavier animals to walk through, but causes problems for lighter animals, which have difficulty moving through it. A crust hard enough to support a deer's weight may mean that a grouse sleeping in the snow is trapped. Crusty snow also can cause a build-up of carbon dioxide in the lower levels of snow so small mammals can't get enough oxygen to survive. Most of the small holes you see in the snow are actually air vents that allow the carbon dioxide, built up from decaying vegetation, to escape.

The large hind feet of the snowshoe hare enable it to move easily over deep snow.

There are hundreds of ways plants and animals interact with snow. It can be beautiful, protective or destructive for all creatures; therefore, it plays an important role in controlling the character and composition of life. By protecting the insects, plants and small mammals from being eaten, and by limiting the food of birds, predators and browsers, snow directly affects the diversity and population of the animals and plants that live here.

hi•ber•nate \hī-bər-nāt\: to enter periods of dormancy

Hibernation or dormancy is the alternative to migration for animals that cannot remain active in winter. True hibernators breathe slowly and unevenly. Their heartbeats slow down and their body temperatures drop substantially. They may remain in this state throughout the winter months. The woodchuck, little brown bat and jumping mouse are true hibernating mammals found in New Hampshire.

Periods of drowsiness and wakefulness followed by profound lethargy is how hibernation begins. Although hibernating animals merely look asleep, they are really in a different state. The majority of mammals who hibernate curl up with their hind legs covering their head so the eyes are hidden. They may breathe as slowly as once per minute. In woodchucks, the body temperature may fall as low as 37.4 degrees F. In summer its body temperature is around 96.8 degrees F. In addition, the heart beats slowly and irregularly during hibernation. When awake, a woodchuck's heart beats at 160 times per minute, but while hibernating the average is four to five times per minute.

ANNOUNCEMENTS

Put a "Focus on New Hampshire Forests" in Your Classroom

New Hampshire Project Learning Tree is excited to announce the release of *Focus on New Hampshire Forests*. This new publication is for PLT-trained educators who wish to teach about New Hampshire's amazing forests. It answers questions like: How long do trees live in New Hampshire? Is all bark the same? What's the difference between hardwoods and softwoods?

Focus on New Hampshire Forests provides details about our forests for the nine most popular activities from PLT's PreK-8 Activity Guide. It is available to educators already trained in PLT and will be provided at all upcoming workshops. For more information, call 1-800-677-1499 or e-mail *info@nhplt.org*.

PLT Launches New Web Site

New Hampshire PLT's web site has undergone some reconstruction and enjoys a new home. You can now reach us at www.nhplt.org. Among the changes in the site, you can now review our popular *Educator's Guide to New Hampshire Forests* on-line!

Wildlife Educator Hired for the North Country

The New Hampshire Fish and Game Department is pleased to announce that Mary Goodyear has been hired to be the first wildlife educator for the North Country. Mary comes to the job from the N.H. Division of Parks with lots of experience in education and interpretive programs. She will work out of the Twin Mountain Fish and Wildlife Center. You can contact her at 846-5108. She will serve as a resource for North Country schools and communities.

N.H. Fourth Grade Water Science Fair

The N.H. Drinking Water Week Coalition will be sponsoring the N.H. Fourth Grade Water Science Fair competition during National Drinking Water Week (May 7-13, 2000). The fair is the culmination of local water science fairs held at schools around the state. The top three student projects from participating schools are invited to compete at the state finals, to be held May 10, 2000, at the Manchester National Guard Armory in Manchester, NH. Prizes are awarded to the most outstanding projects at the state fair. Any fourth grade teacher interested in having his/her class participate should contact Cheryl Wood at Manchester Water Works, 624-6482 to receive a water science fair participation manual.

Opportunity to Participate in Frog Surveys

NHDES intends to conduct additional frog surveys this summer and will again be seeking volunteers (both adults and children) to participate. Information on training dates will be available in the Spring issue of the Project WEB or by contacting Steve Landry at 271-2969 or slandry@des.state.nh.us

Upcoming Workshops and Events

On the Wildlife Trail: Mammal Tracking Workshop. Sat. March 4, Webster Wildlife Area, Kingston. Follow the trail of fox, deer, otter, mink, beaver, and skunk while exploring this majestic and ancient Atlantic white cedar bog. A level woods road, perfect for snowshoeing or cross country skiing, loops around the bog and through beautiful woodlands along the Pow Wow River. For more information, contact Trish at the Society for the Protection of NH Forests at 224-9945.

NH Science Teachers Association K-8 Conference, Thursday, March 23, Phillips Exeter Academy. For more information, contact NHSTA at 229-0043.

NH Environmental Educators Annual Meeting, Thursday, April 13. For more information, contact David Moon at moon@top.monad.net

Discover WILD New Hampshire Day, Saturday April 29, 10 a.m. - 3 p.m., Fish and Game Headquarters-2 Hazen Drive, Concord. For more information contact Judy Silverberg at 271-3211.

NH Drinking Water Week Festival, Wednesday, May 10, 8:30 a.m. – 3 p.m., Manchester National Guard Armory. For more information contact Nicole Clegg at 271-4071.

Earth Day 2000, Saturday, April 22. Events for Earth Day will be centered around the theme of energy issues. For more information, visit www.earthday.org

UPCOMING WILD AND AQUATIC WILD WORKSHOPS

PROJECT WILD

Thursday March 16 and 30 3:30-6:00 pm at Twin Mountain Fish and Wildlife Center.

PROJECT WILD AQUATIC

Wednesday April 12, 8:30 a.m.-3:00 p.m. at Fish and Game Headquarters, Concord.

Wednesday April 19, 3:30-8:30 p.m. at Sandy Point Discovery Center, Stratham.

Thursday May 4 and 11, 3:30-6:00 p.m. at Twin Mountain Fish and Wildlife Center, Twin Mountain.

For information or to register call 271-3211 or e-mail jsilverberg @wildlife.state.nh.us

ON THE H.O.M.E. FRONT

Schoolyards in Winter

Outdoor classrooms don't have to shut down and move indoors when the northeast winter rages. Winter is an excellent time for study of many kinds, a time to make unique discoveries about your school grounds that aren't afforded by other months. To quote a Minnesota teacher, "I figure, you better find out things to do in the winter, because that's half your year."

This is the time to study animal activity, since snow makes tracks so visible. (See "Blanket Protection" to find out where and how to look for sign.) Do a focused census of the entire plant and/or animal population on a few square feet of your site. Rope off an area to keep human traffic out. Choose a spot such as a pond or a lone tree in a field, and observe and record its use by animals. Construct a food web based on your observations. Note which species are native and which were introduced from other parts of the world (exotic).

Track meadow voles through the runways they build in tall grass beneath the snow. Study and compare the different behaviors of squirrels – red, gray, and flying – as well as chipmunks. See the "Animal Tracks" activities from *Ten-Minute Field Trips*, reprinted in *Homes for Wildlife*. Or borrow a Track Kit from Fish & Game.

Another opportunity provided by this cold season is feeder study. Put different kinds of feed in similar feeders, and determine food preferences of different bird species. Compare your findings to their natural diet. Observe the feeders over a period of time, noting what birds visit each, some information about the weather and snow cover, when the birds feed most frequently, and so on. Challenge your students to learn five new birds from studying them at the feeders. With the leaves off the trees, you can more easily observe other places on the school grounds where birds are getting their food, perhaps from berries or seed heads.

You can also take advantage of the bare branches of trees and shrubs to learn identification of flora by buds, twigs, and bark. Start an herbarium with twig samples. Develop your own dichotomous key, or learn to use one. Look into the *Project Learning Tree* activity guide for specifics.

The site inventory activity cards in *Homes for Wildlife* can also be used in the winter months. Try measuring the temperature and sunlight in different areas of the schoolyard, near the building, in shaded areas. Continue a study of "Colors and Hues" and "25-words." This season will reveal new color patterns and prompt different vocabulary responses. Create a seasonal comparison chart, or a continuous prism using colors from all the charts.

Develop a seasonal activity calendar. Refer to *The Curious Naturalist* for examples. Chart the arrival and departure of birds, insects, reptiles and amphibians – any creature that migrates or hibernates.

Investigate galls, the wintering home of insects. An excellent activity from Jenepher Lingelbach's book, *Hands-On Nature,* is reprinted in *Homes for Wildlife*.

For maintaining your schoolyard habitats, winter is a good time to prune shrubs and trees, put up new nesting boxes, clean out old boxes, and pull up frost-killed annuals from garden areas. It's also a good time to do indoor planning: develop an enhancement plan; research wildlife needs on the internet; write a grant proposal; raise plants from seed under grow lights; design a garden; plot a schoolyard habitats budget; develop new activity ideas for using the school grounds; plan for Earth Day in April and International School Grounds Day in May; add to your records book; or create a presentation about your project for community groups.

All of these areas of study feed into an ongoing schoolyard survey. This census information is valuable to your inventory, as it reveals what wildlife and plants you have and how they may be interacting in the depths of winter. So take advantage of the season and expand your outdoor classroom.

SCHOOLYARDS *continued on page 8*

During the winter months the house finch can often be seen at feeders in the southern part of the state.

ICE STORM *continued from page 4*

features important to amphibians. Walter Shortle and Kevin Smith of the USDA Forest Service are monitoring tree growth, health, and insect and disease response of 500 individual trees. Practicing foresters are making observations and reporting them to each other "on the stump" and at professional meetings. These informal reports help build our collective knowledge, hopefully putting us in a better position to respond to the next natural disaster.

For Additional Information

For more information about ice storm '98 and its effects on our forests and trees, visit the UNH Cooperative Extension website at http://ceinfo.unh.edu.icestorm.htm or call their Forestry Information Center at 1-800-444-8978.

Portions of the following references were adapted for this article:

An Evaluation of the Severity of the January 1998 Ice Storm in Northern New England- Report for FEMA Region 1, by K.F. Jones and N.D. Mulherin for the Cold Regions Research and Engineering Laboratory.

Good Forestry in the Granite State: Recommended Voluntary Forest Management Practices for New Hampshire, presented by the New Hampshire Forest Sustainability Standards Work Team.

Ice Storm 98 Information Sheets prepared by the USDA Forest Service.

SCHOOLYARDS *continued from page 1*

Resources:

A Guide to Bird Behavior, Volumes 1 and 2 (ISBN 0-316-81725-2, 0-316-81717-1), and *The Bird Feeder Book* (ISBN 0-316-81733-3), Donald and Lillian Stokes, Little, Brown and Co., Boston, MA.

The Curious Naturalist, John Mitchell, Prentice-Hall, Inc., NJ, 1980 (ISBN 0-13-195404-0)

Hands-On Nature: Information and Activities for Exploring the Environment with Children, Jenepher Lingelbach, VT Institute of Natural Science, 1986 (ISBN 0-9617627-5)

Homes for Wildlife, A Planning Guide for Habitat Enhancement on School Grounds, Marilyn Wyzga, NH Fish & Game, 1994 (ISBN 0-9652156-2-8)

Ten-Minute Field Trips, by Helen Ross Russell, National Science Teachers Association, 1990 (ISBN 0-87355-098-6)

Note: If you can't find copies of these, contact Marilyn Wyzga at 271-3211, mwyzga@wildlife.state.nh.us. or the Center for Environmental Education at www.cee-ane.org

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